work on the Odontornithes, or birds with teeth, and contains a full account of the peculiar order of mammals discovered by him during the last fifteen years in the early tertiary formations of the great central plateau in Wyoming. The old lacustrine basin of this region, where alone the remains of Dinocerata have hitherto been found, have already yielded parts of over 200 individuals, which are now grouped in three genera: Dinoceras, Marsh; Tinoceras, Marsh; and Uintatherium, Leidy. The last-named appears to be the most primitive type, and Tinoceras the most specialised, Dinoceras being intermediate. Of species the number cannot yet be determined, but thirty more or less distinct forms have already been recognised. In stature and movements it appears to have resembled the elephant as much as any other known type, differing from it especially in the shape of the skull, remarkably small brain, longer neck, and more bent fore limbs. It was by far the largest of all known Eocene animals. The paper is enriched with numerous illustrations, and with a map showing the region of Dinoceras beds.—On Taconic rocks and stratigraphy, with a geological map of the Taconic region, by James D. Dana. In this paper the author embodies the results of a fresh study, begun in 1882, of the Taconic region extending over parts of Massachusetts, Connecticut, Vermont, and New York. The rocks described comprise the Taconic skirts of the Taconic range, and subordinate ridges within the adjoining limestone area; the limestone formations on the east and west sides of the Taconic range; and the quartzite adjoining or within the limestone area. All these rocks are regarded as belonging to one system of Lower Silurian age, with the Taconic schists as the upper member of the series. The map is to a scale of half an inch to the mile.—Variations of latitude, by Asaph Hall. The author deals with Signor Fergola's recently-proposed plan for investigating variations of latitude by special series of observations made with the best prime vertical transit instruments on selected lists of stars. A chief feature of the plan is that the work is to be mainly differential, two observatories under the same or nearly the same latitude co-operating.—Notes on the Jurassic strata of North America, by Charles A. White. The paper is mainly a reply to the objections raised by Mr. J. F. Whiteaves, of the Canadian Geological Survey against the classification of certain exposed formations frequently occurring throughout Colorado, Wyoming, Dakota, Utah, and Montana, and usually referred to the Jurassic period.—Meteoric iron from Coahuila, Mexico, by M. T. Lupton. An analysis of a fragment of this meteoric mass, weighing about 192 lbs., yielded: iron, 91·86; nickel, 7·42; cobalt, 50; phosphorus, ·27.—Optical projection of acoustic curves, by W. Le Conte Stevens. Optical presentations of a concord and a discord are shown projected on a screen by a simple and ingenious process.—Measurement of strong electrical currents, by John Trowbridge.—Divisibility of the Archæan formations in the North-West, by R. D. Irving. The region here investigated occupies, as indicated by the accompanying sketch-map, a tract some sixty miles in length between Lake Numakagon, in North Wisconsin, and Lake Gogebic, in North Michigan. The Archæan rocks of this district are referred to the Huronian and Laurentian systems.—Mineralogical notes, by W. E. Hidden. Specimens are described of phenacite and Xenotine, from new localities; of Fayalite, from Colorado; of Zircon, from Canada; and of rutile and emeralds, from North Carolina.

Nachrichten von der K. Gesellschaft der Wissenschaften und der Universität zu Göttingen, August to December, 1884.—A contribution to the theory of the absorption of light in crystals, by W. Voigt.—Remarks on the theory of the cycloid and on all forms of cycloidal curves, by A. Enneper.—Researches on the symmetrical relations and elasticity of crystals, by B. Minnegerode.—On the histology of the Asteridæ, by Dr. Otto Hamann.—On some derivatives of urea, by R. Leuckart.—On the preparation of orthodinitrobenzol in large quantities, by Paul Jannasch.—A contribution to the theory of complex dimensions developed from *n* unities, by K. Weierstrass.—Researches on the optical structure and properties of leucite, by C. Klein.—On some noteworthy archæological object in Treves, by Friedrich Wieseler.—Remarks on Gauss's algebraic series, by J. Thomæ.—On the titrimetric analysis of urea, by Dr. Th. Pfeiffer.—On the development of the reproductive organs in *Limax agrestis*, by J. Brock.—On the classification of the genus Loligopsis, Lam. (*Leachia Lesueur*), by J. Brock.—Remarks on the *Acta Mathematica*, edited by Dr. Gösta Mittag-Leffler, by Ernst Schering.—On the electro-magnetic rotation of a fluid, by Eduard Riecke.—On the inflexion of the present participle and comparative in Mœso-Gothic, by Leo Meyer.

SOCIETIES AND ACADEMIES

London

Royal Society, March 19.—"On 'Transfer-resistance' in Electrolytic and Voltaic Cells." By G. Gore, LL.D., F.R.S.

The existence of this phenomenon has been a matter of doubt ever since the year 1831, and the question has been examined by many investigators. In the present paper are described a series of methods by means of which its reality has been determined. Other methods are given for measuring the amounts of such "resistance," either collectively at the two electrodes of an electrolytic cell, or separately at each electrode. Modes of obviating the interference of polarisation, and of securing success in the measurements, are also described.

The influence of various circumstances upon the phenomenon were investigated—viz. strength and density of current; total resistance; density of current and size of electrode; composition of the electrolyte; strength of ditto; combined electrolytic cells; temperature; and chemical corrosion. The relations of the phenomenon to size of plate in voltaic cells, to the positive and negative plates respectively, and to strength of current in those cells, were also examined, and the results are given.

The following are the chief facts established by this research:—That a species of electric "resistance," distinct from that of polarisation and of ordinary conduction-resistance, varying greatly in amount in different cases, exists at the surfaces of mutual contact of metals and liquids in electrolytic and voltaic cells. That this "resistance" varies largely in amount with different metals in the same solution, and with the same metals in different solutions; in dilute solutions of mineral acids of different strengths, or of different temperatures, and is usually small with easily corrodible metals which form quickly soluble salts, and large with those which are not corroded; and is disguised in the case of those which by corrosion form insoluble salts.

The results of the experiments also show that the same voltaic current was "resisted" in different degrees by every different metal when employed as an anode, and when used as a cathode; also by the same metal when used as an anode and cathode respectively; and that the proportions of such "resistance" at an anode and cathode of the same metal varied with every different metal in every different electrolyte (and strength of electrolyte), and at every different temperature; and that the resistance at the anode was usually smaller than that at the cathode; in some cases, however, where a film was formed upon the anode, an apparently reverse effect occurred; that a current from a given positive plate of a voltaic cell was differently resisted by every different metal used as a negative plate in that cell; and that by rise of temperature "transfer-resistance" was usually and considerably reduced.

They further show that this species of "resistance" was largely reduced by increasing the strength of current; and was thus conspicuously distinguished from ordinary conduction-resistance of the electrolyte. In consequence of this effect, "transfer-resistance" was greatly influenced by every circumstance which altered the ordinary resistance, and thereby the strength of current. The usual effect of diminishing the density of current alone, by enlarging both the electrodes and keeping the strength constant, was to diminish the "transfer-resistance;" and of enlarging one only, was to diminish it at that electrode and increase it at the other, the effect being greatest at the altered electrode; but the influence of density was very much smaller than that of strength of current. The current was usually less "resisted," and larger with a small positive plate and a large negative one, than with those sizes reversed. Alterations of size or kind of metal at one plate of an electrolytic or voltaic cell affected the "transfer-resistance" at the other, by altering the strength and density of the current.

"Transfer-resistance," therefore, appears to vary, not only with every physical and chemical change in the metals and liquids, but also with every alteration in the current. Such "resistance" throws light upon the relative functions of the positive and negative plates of voltaic cells, and illustrates the comparatively small influence of the negative one in producing strength of current. Nearly all these conclusions are based upon results represented by average numbers obtained by series of experiments.

Linnean Society, March 19.—Sir John Lubbock, Bart., President, in the chair.—Dr. J. Grieve and Mr. Chas. T. Druery were elected Fellows of the Society.—Dr. G. J. Romanes exhibited two human crania from South Africa; one was that of an aboriginal bushman from Kruis River, Cango district, Gudtsboora, obtained through Dr. Stroud.—Mr. J. G. Baker drew attention to a specimen of a supposed hybrid between the two genera *Aloe* and *Gasteria*, and grown in the Glasgow Botanic Gardens. He also showed a curious new fern, *Polypodium* (*Niphobolus*) *polydactylon*, Hance, discovered by Mr. W. Hancock, F.L.S., in the Island of Formosa.—A paper was read on new hydroids from the collection of Miss Gatty, by Prof. Allman. Thirty-eight species distributed among twelve genera are described as new. Among these the plumularian genus, *Podocladium*, is very remarkable, not only by the possession of both fixed and movable nematophore, in accordance with which, like *Heteroplon*, of the *Challenger* collection, it holds a position intermediate between the typical Eleutheroplean and the Stetoplean genera, but by the fact that every hydrocladium is supported on a cylindrical jointed peduncle. Among other remarkable and significant forms is one to which the author gives the name of *Thuiaria heteromorpha*. In this are found combined on the same hydrophyton no less than three morphological types, which, if occurring separately, would be justly regarded as representing three genera, *Thuiaria*, *Dermoscyphus*, and *Sertularia*. Notwithstanding this singular combination of forms, the author does not believe that the characters of the specimen justifies the construction of a new genus; and he regards the generic position of the hydroid as determined by that one of the three forms which most decidedly prevailed in it. *Thuiaria heteromorpha* thus shows in a very marked way the indefiniteness of the boundaries between different zoological groups, and calls to mind a phenomena known to occur among plants, as in certain epiphytical orchids, in which the same stem has been observed to carry flowers referable to several generic types.—Then followed a paper by Capt. William Armit, F.L.S., viz. on plants met with by him on Moresby, Basilisk, O'Neill, and Margaret Islands, South Eastern New Guinea, and in which a list of over 130 species are given.

Physical Society, March 14.—Prof. Guthrie, President, in the chair.—Capt. Abney read a paper upon recent researches on radiation. In general a hot body loses heat in three ways: by conduction, by convection, and by radiation. In the case of the carbon filament of an incandescent lamp the loss of heat by conduction is insignificant, and a series of experiments has been made to determine the amount of radiation—that is, the energy expended as radiant heat for every unit of electrical energy expended in the lamp. Mr. Crookes has investigated the subject of radiation in high vacua, the cooling bodies being thermometer bulbs, and has come to the conclusion that, at pressures between 40 millionths and 1 millionth of an atmosphere, the radiation varies as the mean molecular free path. In the author's experiments incandescent lamps of thin glass were exhausted to different degrees, the radiation being measured by a thermopile. It was found that, from 40 millionths to 10 millionths of an atmosphere the radiation increases uniformly with decrease of pressure, but that beyond this point it becomes nearly constant. A more important question is to determine the amount of radiation for any particular ray under the above conditions. This was effected by placing a small thermopile in the different parts of the spectrum. Plotting the results with watts as abscissæ, and radiation as ordinates, the curves for each kind of ray are found to be very accurately hyperbolas with vertical axes. This result gives a method for rendering identical the quality of the light emitted by two lamps. We have only to find the radiation corresponding to a particular kind of light for one lamp, and then, by examining the curve corresponding to that ray for the other lamp, find for what number of watts the radiation is the same.—Prof. J. A. Fleming read a paper on characteristic curves of incandescent lamps. The author has collected a number of statistics connecting the life, resistance, efficiency, and potential difference of incandescent lamps, and has examined them with a view of showing the mutual relations of these variables by empirical equations. A curve showing the relation of any one of them to any other is called a characteristic curve of the lamp. Among the various results arrived at was the confirmation of the law, announced by Profs. Ayrton and Perry at the last meeting of the Society, that for a certain class of lamps the potential difference, minus a constant, varies as the cube-root of the efficiency, the latter quantity being measured by candles per horse-power. The constant, which, in the lamps examined, is about 28·7, is nearly the potential difference at which the lamp begins to emit light; hence the law may be put into this form: The effective potential difference varies as the cube-root of the efficiency. Using the results obtained, the author then solved the problem of determining the conditions for a minimum cost per candle, and obtained a result closely agreeing with that communicated at the last meeting by Profs. Ayrton and Perry. In answer to Lord Rayleigh, Dr. Fleming stated that he had not calculated the increase of cost due to a variation from the most favourable conditions; it had been shown, however, by Messrs. Ayrton and Perry that the increase of cost due to a variation of potential difference amounting to 3 or 4 per cent. upon either side of the value corresponding to least cost was very small.—Mr. C. Cleminshaw described some further experiments on spectrum analysis. These consisted of methods of obtaining the inversion of the sodium line in the spectrum of the limelight. The first consisted in concentrating the rays from the slit by a lens, just beyond the focus of which is a spoon in which sodium is ignited by a Bunsen flame. In the second method the burner and sodium are introduced between the lime and the slit, and carbonic acid is introduced into the flame. The result in either case is to cause the inversion of the D line. Prof. Guthrie, alluding to the pale blue flame produced by common salt in a coal fire, suggested that there might be more than a mere mechanical action produced by the carbonic acid. Mr. Cleminshaw, however, believed that the action was purely mechanical.—An abstract of a communication by Dr. John Hopkinson on Sir W. Thomson's quadrant electrometer was read by the Secretary. According to Maxwell, the deflection produced by a given difference of potential between the quadrants is given by the formula—

$$d = \lambda(A - B)\left(C - \frac{A + B}{2}\right)$$

where A and B are the potentials of the quadrants, and C that of the needle. Dr. Hopkinson finds, however, that the constant λ should be $\frac{\lambda}{1 + kC^2}$, the quantity k being due to and depending on the unsymmetrical position of the needle with respect to the quadrants.

Zoological Society, March 17.—Prof. W. H. Flower, LL.D., V.P.R.S., President, in the chair.—Mr. Sclater exhibited and made remarks on a duck shot on Lord Bolton's estate in Yorkshire which appeared to be a singular variety of the Scaup (*Fuligula marila*).—Mr. W. B. Tegetmeier, F.Z.S., exhibited and made remarks on a pair of abnormal deer's antlers obtained in India.—Dr. F. H. H. Guillemard read a paper on the ornithology of the Sulu Archipelago, showing that the *ornis* of that group is purely Philippine, and that the line of separation between the latter archipelago and Borneo lies between the islands of Sibutu and Tawi-tawi. Dr. Guillemard added fifty species to the list of birds hitherto known from Sulu, two of which were new to science.—A communication was read from Mr. T. Kirsch, of the Royal Zoological Museum, Dresden, containing descriptions of some new butterflies obtained by the collectors of Mr. Riedel in Timor-Laut.—A communication was read from Prof. W. Nation, C.M.Z.S., containing some notes on the Peruvian cliff-swallow (*Petrochelidon ruficollis*).—A communication was read from the Rev. H. S. Gorham containing a revision of the Phytophagous Coleoptera of the Japanese fauna, of the sub-families *Cassidinæ* and *Hispinæ*.—A communication was read from Lieut.-Col. C. Swinhoe, F.Z.S., being the second of his series of papers on the Lepidoptera of Bombay and the Deccan. The present paper treated of the first portion of the Heterocera.—Dr. Hans Gadow, C.M.Z.S., gave an account of the anatomical differences observed during an examination of examples of the three species of rhea (*Rh. americana*, *macrorhyncha*, and *darwini*).

Chemical Society, March 19.—Dr. W. H. Perkin, F.R.S., President, in the chair.—The following papers were read:—On the presence of choline on hops, by Dr. Griess, F.R.S., and Dr. G. H. Harrow.—Fluorene, Part III., by Dr. W. R. Hodgkinson.—Combustion in dried gases, by H. Brereton Baker, B.A.

Entomological Society, March 4.—The President in the chair.—Four new members were elected.—Mr. T. R. Billups exhibited specimens of *Ceraleptus lividus*, Stein, from Chobham.—Rev. W. W. Fowler exhibited the unique specimen of *Cerylon* *atratulum*, Reitt.; and specimens of an Indian *Cassida* in which the colours were preserved. Dr. Sharp remarked on the colouring matter of the *Cassididæ*. Mr. Fowler likewise exhibited a microscopical movable stage, suited to entomological purposes.—Mr. W. F. Kirby exhibited a variety of *Spilosoma lubricepeda*, Esp., which had been found in the British Museum (Natural History), South Kensington.—Mr. A. G. Butler communicated a few observations touching M. De Nicéville's recent suggestions on seasonal dimorphism in the Lepidoptera, which gave rise to some discussion.—Dr. D. Sharp remarked on the recent discovery of two different forms of spermatozoa in *Helops striatus*, Fonsc.—Papers read:—A monograph of British *Braconidæ*, Part 1, by the Rev. T. A. Marshall.—Descriptions of new species of Languriidæ, by the Rev. W. W. Fowler.—On the discovery of a species of the Neuropterous family, *Nemopteridæ*, in South America, with general considerations regarding the family, by Mr. R. McLachlan.

Mineralogical Society, March 10.—The Rev. Prof. Bonney, D.Sc., F.R.S., President, in the chair.—Messrs. James Currie, Alfred Harker, and M. Alfred Lacroix were elected members.—The Secretary read a paper by M. H. Sjögren (communicated by Dr. Hugo Müller) on the crystalline character of graphite.—Mr. W. Semmons read a paper on a new discovery of connelite.—The balance sheet of the Society for the year 1884, which will be issued with the next part of the *Journal*, showed the Society's financial position to be satisfactory.

Institution of Civil Engineers, March 24.—Sir Frederick J. Bramwell, F.R.S., President, in the chair.—The paper read was on the electrical regulation of the speed of steam-engines and of other motors for driving dynamos, by Mr. P. W. Willans.

EDINBURGH

Royal Physical Society, March 18.—Mr. B. N. Peach, F.R.S.E., F.G.S., President, in the chair.—The following communications were read:—On certain peat and tarn deposits in the North of England, by Mr. Hugh Miller, F.G.S., Assoc.R.S.M.—Mr. Robert Kidston, F.G.S., described three new species of Fossil Lycopods from the carboniferous formation: *Sigillaria M'Murtrie*, from Redstock; *Sigillaria Coriacea*, from the Newcastle coalfield; and *Lepidodendron Peachii*, from Falkirk.—On the chemical composition of some samples of Scotch ensilage, by Mr. W. Ivison Macadam, F.C.S., F. Inst. Chem.—Specimens and sections of caseous tumours, found in the muscles of a hake, were described and exhibited by G. Sims Woodhead, M.D., F.R.C.P.E., who had received them from Dr. R. H. Traquair, F.R.S. These caseous masses were composed of broken-down muscular fibre, which appeared to have undergone a peculiar waxy or vitreous degeneration. Surrounding these was an area of young cellular tissue, with a considerable number of blood-vessels, and around this cellular area the muscles were undergoing the same peculiar waxy change. No parasite could be found, and it was suggested that the change might be due to violent muscular action. Dr. Woodhead also showed specimens of the liver of a fowl, in which were numerous caseous nodules. In these bacilli were found in very considerable numbers, giving the same reactions as Tubercle and Lepra bacilli. Mr. Owen Williams, M.R.C.V.S., in the discussion which ensued, mentioned that tuberculosis was often found in highly-bred fowls, and in rabbits.

PARIS

Academy of Sciences, March 23.—M. Bouley, President, in the chair.—Remarks on the map of France issued by the Dépôt de la Guerre to the scale of 1 : 200,000, with specimen sheets of a new map of France to the scale of 1 : 50,000 by Col. F. Perrier. Of the War Office map, the six first sheets, embracing the districts of Metz, Nancy, Vesoul, Troyes, Dijon, and Châlons-sur-Marne, are finished. The whole, comprising eighty sheets, 0·64m. by 0·40m., is to be completed within the year 1889, and will form a superb specimen of modern cartography.—Experimental researches on the electric excitability of the brain, properly so-called, by M. Vulpian. The author's experiments on the dog, cat, monkey, and other animals, lead him to infer that the arguments hitherto used to prove the excitability of the grey cortical substance at certain determined points are groundless, and fail altogether to support the hypothesis of local cerebral functions.—Remarks in reply to some criticisms of M. Friedel on the existence of the hydrate of chloral in the state of vapour, by M. L. Troost.—A comparative study of vessels from the standpoint of the propelling force, by M. A. Ledieu.—A simple demonstration of Lambert's theorem on the mutual action of the sun, the earth, and of a celestial body observed from the latter, by M. E. Vicaire.—On the integers of total differentials, by M. E. Picard.—Description of an electric pile acting with a single bichromate fluid, and presenting special conditions of constance, by M. Mascart.—Chemical and physiological effect of light on chlorophyll, by M. C. Timiriazeff.—Relations between the ultra-violet spectrum of the vapour of water and the telluric bands A, B, α of the solar spectrum, by M. H. Deslandres.—On the preparation of ammoniac gas, by M. Isambert.—On a monochloruretted and monobromuretted isomerous camphor, by M. P. Cazeneuve.—On the di-ethylamido-α-butyric acid, by M. E. Duvillier.—On the existence of three ganglia in the auditory nerve of man, forming a zone of cellules analogous to one of those found in the retina, by M. E. Verrier.—On a new type of Cordaïteæ largely represented in fossil vegetation, by MM. B. Renault and R. Zeiller.—A contribution to the study of the Eocene ferns in the West of France, by M. L. Crié.—On the upheaval of the Côte-d'Or range, by M. J. Martin. Contrary to the generally-received opinion, which assigns this range to a period intermediate between the Jurassic and Cretaceous, the author argues that it is in reality posterior to the latter.—Supplementary remarks on the gigantic turtles of Madagascar, by M. L. Vaillant. From the remains found by M. Grandidier at Etsere and Ambulitsate the author determines two distinct species, which he names *Testudo Grandidieri* and *Testudo abrupta*.—On the production of a new crystallised phosphate of magnesium and the corresponding arsenate, by M. A. de Schulten.—Description of the cylindrograph, a new photographic apparatus which, by a simple rotation of the objective, enables the surveyor to obtain views of the landscape embracing an angle of about 170°, by M. Moessard.

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